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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/726,860	11/30/2000	Etsuo Morita	09792909-4715	1967

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EXAMINER

ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 07/23/2002

11

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/726,860

Applicant(s)

MORITA, ETSUO

Examiner

Matthew A. Anderson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 13 May 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 7-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 7-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 November 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 10.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**DETAILED ACTION**

***Election/Restrictions***

1. Applicant's cancellation of claim 6 effectively renders the required species election in paper #8 moot.

***Claim Rejections - 35 USC § 112***

2. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The reader is not appraised of the subject matter regarding the mask and its dissolution behavior in an unnamed solution. The 1<sup>st</sup> mask overlayer and the 2<sup>nd</sup> mask must be dissolved by some unnamed solution which cannot also dissolve the underlayer of the first mask layer. There is no basis for the reader to determine the metes and bounds of the claim.
3. Claim 4 recites the limitation "the same solution" and "the solution" in lines 4 and 6, respectively. There is insufficient antecedent basis for this limitation in the claim.
4. Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "predetermined" renders the claim indefinite. The below rejection is based on the assumed removal of this term.

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5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-3, 5, 7- 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kiyoku et al. (US 6,153,010) in view of Sugiura (US6,015,979).

Kiyoku et al. discloses methods of growing nitride semiconductors. Figs. 6a-6C show an embodiment of the methods presented. The method is described in col. 13 (lines 25+) and col. 14 lines 1-65. A monocrystalline substrate (11) is overlaid with an underlayer (also known in the art as a buffer layer). The material choices for the substrate are given as sapphire (known chemically as  $\text{Al}_2\text{O}_3$ ), spinel (chemically,  $\text{MgAl}_2\text{O}_4$ ), SiC of any of the 6H, 4H and 3C polytypes, ZnS, , GaAs, Si, and (although they are less preferred) ZnO or  $\text{La}_x\text{Sr}_{1-x}\text{Al}_y\text{Ta}_{1-y}\text{O}_3$ . (see col. 7 lines 20-25.) The buffer layer can be AlN, GaN, AlGaN, or InGaN. (col. 13 lines 10-20). The mask is described as being one or a combination of oxides and nitrides such as silicon dioxide ( $\text{SiO}_2$ ), silicon nitride ( $\text{Si}_3\text{N}_4$ ), titanium oxide ( $\text{TiO}_2$ ) and zirconium oxide ( $\text{ZrO}_2$ ). Also the metals with melt in points greater than 1200°C can be used. These include W, Ir, Pt, Ti etc. Stripe, dots or lattice patterns are disclosed for the mask in col. 8 lines 25-35. In col. 14 lines 33-40 it is disclosed that repeated cycles of growth mask formation followed by nitride growth. Polishing the grown nitride is disclosed in col. 13 lines 25-40 to provide a flat growth surface before additional growth iterations are performed. In

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col. 12 lines 5-15 it is disclosed that the dissimilar substrate (i.e. the basal layer) may be removed from the formed device. The use of a superlattice or graded buffer layer (the first crystal layer) is described in col. 20 lines 20-30 as formed from alternating nitride layers having different compositions.

Kiyoku et al. does not suggest the same method of forming the growth masks as is used in the application.

Sugiura et al. discloses the formation of growth masks for nitride epitaxy as in Fig. 11. This is disclosed in col. 18 lines 9-35 as consisting of a nitride layer on which a  $\text{SiO}_2$  layer is formed. This layer is then patterned using a electron beam resist and patterned using a dry etching technique. This suggests etching the underlying nitride layer since the oxide is completely etched through to expose the underlying layer.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the references cited because Kiyoku et al. discloses the formation of patterned striped growth masks on a nitride layer and Sugiura et al. discloses an alternative method of forming such masks on a nitride layer and such formed masks would have been anticipated to produce an expected result. The motivation for the combination is the increased process flexibility thus afforded.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to perform a second growth step through the etched mask and the etched first crystal (i.e. buffer layer) because this was the essence of Kiyoku et al.'s disclosure concerning the Figs. 1A-1C with the modification of Sugiura as above.

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It would have been obvious to one of ordinary skill in the art at the time of the present invention to perform a second mask formation step, a second etching step to form the second layer through the second pattern and a third nitride growth step because this was the essence of Kiyoku's Figs. 6A-6C with the above modification of Sugiura et al.

It would have been obvious to one of ordinary skill in the art at the time of the present invention that the second etching step include removing at least part of the mask pattern because such removal of parts of the mask pattern is suggested by Sugiura et al. and would have been anticipated to produce an expected result.

It would have been obvious to one of ordinary skill in the art at the time of the present invention that the mask pattern include an underlayer and an upper layer because Kiyoku et al. discloses multi-layer growth masks.

It would have been obvious to one of ordinary skill in the art at the time of the present invention that the windows of the first mask and the second mask do not overlie one another in the direction of the thickness of the crystal because such is shown in Fig. 6A-6C and such placement of growth masks would have been anticipated to produce an expected result.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to remove the basal layer after the growth of the device layers of nitride is completed because such is suggested by Kiyoku et al. and such would have been anticipated to produce an expected result.

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It would have been obvious to one of ordinary skill in the art at the time of the present invention to form a buffer layer of alternating nitride layers because such is suggested by Kiyoku et al. and would have been anticipated to produce an expected result.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to form the first mask layer in stripes arranged in one direction in a plane almost parallel to the surface of the basal plane because Kiyoku et al. discloses flattening the layer before subsequent growth and such planarization would have been anticipated those of ordinary skill in the art to produce an expected result.

It would have been obvious to one of ordinary skill in the art at the time of the present invention that the first and second mask pattern include elements arranged in two directions in a plane almost parallel to the surface of the basal body (i.e. in a lattice pattern) because such is explicitly suggested by Kiyoku et al. and such an arrangement would have been anticipated to produce an expected result.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to use silicon oxide or silicon nitride masking materials because such were explicitly suggested by Kiyoku et al.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to use a substrate (i.e. basal body) of sapphire, or SiC or GaAs etc. because such is disclosed by Kiyoku et al. and would have been anticipated to produce an expected result.

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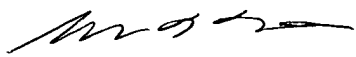
**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA  
July 15, 2002

  
BENJAMIN L. UTECH  
SUPERVISORY PATENT EXAMINER  
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